

15 Vocabulary and Reading Comprehension

The Nexus of Meaning

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In his classic 1944 article titled "Fundamental Factors in Reading Comprehension," Frederick B. Davis wrote, "It is clear that word knowledge plays a very important part in reading comprehension" (p. 191). Davis's statement has been used often, perhaps glibly, as a truism about the connection between vocabulary and reading comprehension. Indeed, there are various relationships between word knowledge and text understanding (Anderson & Freebody, 1981; Baumann, 2005; Nagy & Scott, 2000). Although it may be "clear" that vocabulary "plays a very important part in reading comprehension," the simplicity of the assertion belies its knottiness, as was acknowledged by the National Reading Panel (NRP) (2000): "Precisely separating the two processes is difficult, if not impossible" (pp. 4–15). Further, it may be conventional wisdom that vocabulary knowledge affects reading comprehension directly, but, as Baumann, Kame'enui, and Ash (2003) noted, "The evidence of a causal link between vocabulary and comprehension is historically long but empirically soft" (p. 758).

It is the purpose of this chapter to explore the nature of the complexities between vocabulary and reading comprehension, that is, to examine the nexus of meaning between understanding individual concepts and the broader comprehension of connected text. This chapter is organized into three sections. First is a presentation of theoretical and historical perspectives linking vocabulary and comprehension. Second is a review of significant research that examines if and how pedagogical attention to vocabulary influences reading comprehension. I close the chapter with a conclusion section that includes a summary and implications for research and practice.

THEORETICAL AND HISTORICAL PERSPECTIVES

Vocabulary and comprehension relationships

Evidence for the relationship between vocabulary knowledge and reading comprehension comes from several sources, including descriptive analyses, correlational studies, and examinations of readability and achievement test data.

Descriptive analyses The first significant attention to connections between vocabulary knowledge and word comprehension was provided in the early 20th century in a series of works by E. L. Thorndike (1917a/1971, 1917b, 1917c). For example, in his oft-cited article titled "Reading as Reasoning" (1917a/1971), Thorndike analyzed readers' "mistakes" to comprehension questions after reading short paragraphs and concluded that understanding the meanings of words was prerequisite (although not necessarily sufficient) for readers to understand the overall passages.

Correlational studies Several researchers explored vocabulary-comprehension associations several decades later using correlational and factor analytic methods. Davis (1944), in his "Fundamental Factors" study, examined relationships among nine indices of text understanding. He found that word knowledge correlated highly with various comprehension tasks, and a factor analysis revealed two key components: a broad comprehension measure he referred to as "reasoning in reading" and another he labeled "word knowledge" (p. 191). Several years later, Thurstone (1946) reanalyzed Davis's (1944) data using an alternate statistical procedure and challenged Davis's findings, reporting that there was only a single factor ("reading ability," p. 185). Thurstone did acknowledge, however, that one of Davis's tests—knowledge of word meanings—did demonstrate specific, unique variance.

About 20 years later, Davis (1968) returned to the issue of identifying components of reading comprehension and conducted a modified replication of his earlier work. He again reported that comprehension consisted of multiple components, with vocabulary being the most pronounced. Davis (1972) and Spearritt (1972) examined the 1968 Davis data further and, although they had somewhat different interpretations, they agreed about the centrality of vocabulary to comprehension. Rosenshine (1980) reviewed the same literature and concluded that "*different analyses yielded different unique skills, ... [but] only one skill was consistent across the three analyses: remembering word meanings*" (p. 543).

Examinations of readability and achievement test data Measures of readability, or "ease of comprehension" (Harris & Hodges, 1995, p. 203), also provided insight into vocabulary-comprehension links. For example, Klare's (1974–1975) analyses of readability formulas revealed that a semantic factor (word knowledge) was the most powerful in predicting passage comprehension. Bloom (1976) noted that vocabulary and comprehension achievement tests correlated highly, and R. L. Thorndike's (1973) analysis of achievement test data in 15 different countries revealed strong relationships between vocabulary and comprehension tests.

In summary, on the basis of various analyses conducted over the first three quarters of the 20th century, it was generally accepted that vocabulary was indisputably linked to reading comprehension.

Explanations for vocabulary-comprehension relationships

In 1981, Anderson and Freebody wrote a highly influential chapter in which they sought to "summarize what is known about the role of vocabulary knowledge in reading comprehension" (p. 77). After documenting the strong vocabulary-reading comprehension association, Anderson and Freebody proposed three hypotheses, or positions, for the strong association: the instrumentalist, aptitude, and knowledge position.

1. *Instrumentalist*: This position posits that knowing word meanings is instrumental for, or enables, reading comprehension in a causal way. The implication of this perspective is that teaching word meanings should promote reading comprehension.
2. *Aptitude*: This position suggests that vocabulary is reflective of general aptitude, that is, persons with both a large vocabulary and strong reading comprehension are a function of them having "a quick mind" (Anderson & Freebody, 1981, p. 81). Thus, vocabulary and comprehension are both influenced by a third factor, overall verbal aptitude.
3. *Knowledge*: This view hypothesizes that vocabulary and comprehension are reflective of overall knowledge or schema. Therefore, a readers' general conceptual knowledge promotes or causes reading comprehension, not word knowledge per se.

Instead, vocabulary knowledge is indicative of a reader's broader knowledge base about a topic and the words used to describe it.

Other vocabulary researchers and theorists expanded upon or added to the three positions outlined by Anderson and Freebody (1981), providing additional views on vocabulary-comprehension relationships.

4. *Access*: Mezynski (1983) suggested that comprehension of text is a function of a reader's ability to efficiently locate and access word meanings when reading. Built on the theory of automaticity in reading (LaBerge & Samuels, 1974), this position suggests that the more quickly a reader can access semantic meanings (Stahl, 1991), the deeper the text comprehension.
5. *Input*: Krashen (1985) asserted that language acquisition is dependent on "comprehensible input," or connected text that is just beyond a language learner's current level of competence (Vygotsky, 1978). Although intended to explain vocabulary development in a second language, Krashen's position has been extended to first-language vocabulary development and has been used to argue for extensive independent reading (Krashen, 1989, 2004).
6. *Metalinguistic*: Nagy (2005) argued that one important dimension of the aptitude hypothesis involves a reader's metalinguistic awareness, or "the ability to reflect on and manipulate language" (p. 32) with respect to syntax, morphology, semantics, and other cues. Nagy (2007) asserted further that "some of the correlation between vocabulary knowledge and reading comprehension can be accounted for by appealing to the relationship of each of these with a third construct, metalinguistic awareness" (p. 54).

So, which of these hypotheses is "correct"? As will be obvious from the following review, this is the wrong question to ask. Given the complexity of vocabulary-comprehension relationships, there are instances in which each hypothesis (or a combination of several) has explanatory power and other instances in which one or more hypotheses do not. Working from the stance that all the hypotheses hold some ability to explain the vocabulary-comprehension nexus, I now turn to a review of the pedagogical literature.

PEDAGOGICAL ATTENTION TO VOCABULARY AND EFFECTS ON READING COMPREHENSION

For the purpose of this chapter, I view vocabulary instruction broadly, using the term *pedagogical attention* to denote that there are multiple direct and indirect ways to promote word knowledge. Likewise, I argue, that the research literature reveals that varying forms of pedagogical attention to vocabulary have different relationships to reading comprehension, and hence might be explained by different hypotheses. But first, I describe a structure for organizing the vocabulary-comprehension research.

A Framework for Effective Vocabulary Instruction

The research and theory on vocabulary instruction is long and rich (Beck & McKeown, 1991; Blachowicz & Fisher, 2000; Petty, Herold, & Stohl, 1967), and there has been considerable interest recently on theoretically based vocabulary instructional practices (Baumann & Kame'enui, 2004; Beck, McKeown, & Kucan, 2002; Block & Mangieri, 2006; Hiebert & Kamil, 2005; Stahl & Nagy, 2006; Wagner, Muse, & Tannenburg, 2007). One of the issues discussed in this literature has been the implementation of multi-faceted vocabulary instruction programs (Blackowicz & Fisher, 2000, 2006; Graves, 1987; Graves & Prens, 1986; McKeown & Beck, 1988; Nagy, 1988). Graves

(2000, 2006) proposed a wide-ranging, theoretically based, four-component framework for comprehensive vocabulary instruction. These components are "(1) providing rich and varied language experiences; (2) teaching individual words; (3) teaching word-learning strategies; and (4) fostering word consciousness" (Graves, 2006, p. 5). Adopting Graves's framework, I address in the following subsections how vocabulary instructional actions related to each component may or may not promote reading comprehension.

Providing rich and varied language experiences

Graves (2006) stated that "one way to build students' vocabularies is to immerse them in a rich array of language experiences so that they learn words through listening, speaking, reading, and writing" (p. 5). There is considerable research examining how exposure to texts is associated with vocabulary enhancement, and there is some indication that this growth through exposure affects or mediates comprehension (Cunningham, 2005). Two related literatures are germane to this component: research on reading aloud to students and research on having students engage in independent reading.

Reading aloud to students It has been argued that reading aloud to children is one of the most effective ways to promote their early literacy development (Adams, 1990; Anderson, Hiebert, Scott, & Wilkinson, 1985). Research reveals consistent associations between reading aloud and vocabulary development when preschool and elementary teachers read aloud to children (NRP, 2000; van Kleeck, Stahl, & Bauer, 2003) and when parents read to their preschoolers (Scarborough & Dobrich, 1994). For instance, a meta-analysis by Bus, van IJzendoorn, and Pellegrini (1995) revealed an overall effect size of .67 for the frequency of parent read-alouds to their preschool children and measures of oral language, which included vocabulary knowledge.

Simply reading books aloud to children is associated with vocabulary gains (e.g., Elley, 1989, Experiment 1), although multiple readings appear to be more facilitative than single readings (Senechal, 1997). Repetition of words within a text (Elley, 1989, Experiment 2; Robbins & Ehri, 1994) also enhances vocabulary acquisition from read-alouds.

Reader-listener interaction facilitates vocabulary acquisition during read-alouds (e.g., Dickinson & Smith, 1994; Lonigan & Whitehurst, 1998; Wasik & Bond, 2001). For instance, Wasik, Bond, and Hindman (2006) taught Head Start teachers to ask questions, build vocabulary, and make connections as they read aloud to their classes. Following a school year's implementation of the program, results revealed that children in the intervention classrooms outperformed children in control classrooms on vocabulary measures ($d = 0.73$ for receptive vocabulary; $d = .44$ for expressive vocabulary).

Researchers have evaluated various techniques for teaching vocabulary explicitly while reading aloud to young children (e.g., Beck & McKeown, 2001, 2007a; Coyne, Simmons, & Kame'enui, 2004; Juel & Deffes, 2004; Juel, Biancaross, Coker, & Deffes, 2003). For example, Biemiller and Boote (2006) explored the effects of kindergarten, first-grade, and second-grade teachers' word explanations when reading children's books aloud multiple times. In Study 1, children averaged a pretest/posttest gain of 12% for simply reading a book multiples times, with an added gain of 10% for words explained (22% gain total). In Study 2, the researchers increased the number of words taught and added daily and final reviews of word taught, reporting a pretest/posttest gain of 41%.

It should be noted, however, that even though the relationship between reading aloud and vocabulary is statistically reliable in many studies, the overall magnitude of the association between listening to books and children's language and literacy develop-

ment is often modest in magnitude (Williams, 2007). For instance, on the basis of their review of studies examining the effects of parents reading aloud to their preschoolers, Scarborough and Dobrich (1994) reported that parent read-alouds accounted for no more than 8% of the variance in children's literacy and language abilities. Beck and McKeown (2007a) commented that studies examining the effects of "just reading aloud" on vocabulary revealed associations that ranged "from nonexistent to unimpressive" (p. 252).

What about possible relationships between and among reading aloud, vocabulary, and comprehension? Bus et al. (1995) reported an effect size of .55 for parent read-alouds on children's later reading achievement (which included comprehension). In another meta-analysis, Scarborough (1998, 2002) noted that the median correlation between kindergartners' expressive vocabulary and later reading performance (again including comprehension) was .49, with a correlation of .38 for receptive vocabulary. Morrow (1989) reported that kindergartners' comprehension of stories was enhanced by adult read-alouds, and there was some evidence that a small-group format (as opposed to one-on-one or large groups) was more effective in promoting story comprehension (Morrow & Smith, 1990).

In contrast, however, Meyer, Wardrop, Stahl, and Linn (1994) reported a negative relationship between the time kindergarten teachers spent reading to students and their reading achievement. Meyer et al. affirmed that there are benefits to reading aloud to children but that doing so is not "magical" in itself. Instead, they commented, that it is the quality of read-aloud events and the presence of other literacy activities that may relate to or influence young children's literacy achievement as much as simply reading aloud.

Senechal, Ouellette, and Rodney (2006) sought to tease out the relationship between vocabulary and later reading ability, referring to this association as "the misunderstood giant." They argued that reading aloud predicts children's language well but not children's early literacy abilities. Senechal et al. reanalyzed data from several longitudinal studies and found that children's vocabulary in kindergarten predicted reading comprehension in Grades 3 and 4 but not in Grade 1. The data, they argued, indicated that storybook reading has an indirect relationship to reading comprehension, with oral vocabulary being the mediating factor. Senechal (2006) suggested, therefore, that the dictum that there is no better way to prepare a child to learn to read than by reading aloud to her or him (Anderson et al., 1985) might be recast as "shared reading is an important activity because it can enhance children's vocabulary, which in turn, will be a strong predictor of children's comprehension in later grades" (p. 80).

Independent reading by students Some reading theorists have argued that children learn to read by reading (Smith, 1976). In other words, the more exposure learners have to written texts—at home or school—through independent, self-selected reading, the greater the reading development, including vocabulary acquisition (Krashen, 2004). A number of studies have demonstrated that students in the upper elementary and middle grades do learn word meanings just by reading (Anderson, 1996; Herman, Anderson, Pearson, & Nagy, 1987; Jenkins, Stein, & Wysocki, 1984; Nagy, Anderson, & Herman, 1987; Nagy, Herman, & Anderson, 1985; Schefelbine, 1990). There also is evidence that vocabulary can be acquired when reading electronic texts (Higgins & Cocks, 1999). Vocabulary-learning-by-reading also appears to be a cross-cultural phenomenon (Shu, Anderson, & Zhang, 1995) and applies to both first- and second-language acquisition (Krashen, 1989; Nagy, 1997).

Swanborn and de Glopper (1999) conducted a meta-analysis of 20 studies that explored incidental word learning during reading. Results demonstrated that, on average, "under natural reading circumstances students will spontaneously derive and learn

the meaning of about 15 words of every 100 unknown words they encounter" (p. 279). This is three times as high as the commonly cited 5% chance of learning a word estimated by Nagy, Anderson, and Herman (1987). Swanborn and de Glopper explained this difference due to their use of an assessment approach sensitive to partial word knowledge.

Swanborn and de Glopper's (1999) analysis also suggested that students develop in ability to infer word meanings as they grow older. For example, students at Grade 4 demonstrated a .08 probability of learning a word, whereas a student at Grade 11 had about a .33 probability. Whether this growth in ability to use context is simply a maturational phenomenon or a function of intervening instruction, however, is a matter still unresolved.

Cunningham and Stanovich (1997, 1998, 2003) have provided longitudinal, correlational evidence for a wide-reading/vocabulary relationship. Employing hierarchical multiple regression procedures (see Stanovich & Cunningham, 2004), Cunningham and Stanovich (2003) documented that "avid readers excel in most domains of verbal learning" (p. 669) but vocabulary in particular. Drawing from the work of Hayes and Ahrens (1988)—which demonstrated that printed text is much more lexically complex than oral text—Cunningham and Stanovich argued that wide, independent reading, as measured by reading volume, "is the prime contributor to individual differences in children's vocabularies" (1998, p. 9).

Not all research, however, supports the notion that students learn words by simply reading (NRP, 2000). Several analyses suggest that written context may be not particularly rich and, in some instances, might be misleading (Baldwin & Schatz, 1986; Beck, McKeown, & McCaslin, 1983). Wilkinson, Wardrop, and Anderson's (1988) reanalysis of data by Leinhardt, Zigmond, and Cooley (1981) found little effect of silent reading on the reading achievement of elementary students with learning disabilities. Carver and Liebert (1995) found no evidence that students in Grades 3–5 who read relatively easy library books while enrolled in a summer reading program progressed in reading ability. Gardner's (2004) genre analysis of reading materials for children revealed that expository texts tended to have specialized vocabularies with much higher lexical density than narratives. Thus, she cautioned educators not to assume that incidental word learning when reading nonfiction will be as facile as when reading narratives.

In addition to the relationship between independent reading and vocabulary growth (e.g., Nagy, Anderson, & Herman, 1987; Nagy, Herman, & Anderson, 1985), and there is evidence of a link between independent reading and reading comprehension (e.g., Anderson, Wilson, & Fielding, 1988; Cipelewski & Stanovich 1992; Greaney, 1980; see Anderson, 1996). For instance, Jenkins et al. (1984) reported that fifth graders who were exposed to low-frequency words in passages they read independently not only learned those words but also were "better able to comprehend those parts of the stories involving key vocabulary when they had previously read the vocabulary in other passages" (p. 783). Taylor, Frye, and Maruyama (1990) examined the relationship between fifth-grade students' time spent reading at home and at school and their reading achievement as measured by a standardized reading comprehension measure. Even after controlling for prior reading achievement, Taylor et al. found that the volume of independent reading at school (but not at home) contributed to students' reading comprehension ability.

In summary, there is considerable evidence that providing children and adolescents rich and varied language experiences, particularly through exposure to texts read aloud and through their independent reading, positively affects vocabulary development. Anderson (1996) estimated that "at least one-third, and maybe as much as two-thirds, of the typical child's annual vocabulary growth comes as the natural consequence of

reading books, magazines, and newspapers" (p. 64). In addition, there is some evidence that exposure to oral and written texts enhances students' understanding of the textual information.

Teaching individual words

Much of the research on vocabulary instruction addresses how one might teach students the meanings of specific words. This research is summarized in classic syntheses (e.g., Dale & Razik, 1963; Petty et al., 1967), influential reviews from the 1980s (e.g., Graves, 1986; Herman & Dole, 1988; Jenkins & Dixon, 1983; Mezynski, 1983), meta-analyses (e.g., Stahl & Fairbanks, 1986), and more contemporary reviews (e.g., Baumann et al., 2003; Blachowicz & Fisher, 2000; Jitendra, Edwards, Sacks, & Jacobson, 2004; Nagy & Scott, 2000; NRP, 2000). Although the literature on teaching word meanings is large, the RAND Reading study group (Snow, 2002) noted that "the number of studies that have directly examined the effects of vocabulary instruction on reading comprehension is still relatively small" (p. 36).

Overview of research What does the "relatively small" literature tell us about the effects of teaching individual words on text comprehension? Three reviews from the 1980s captured then, and still do now, some of the key principles (and limitations) of the extant research in this area. First, Mezynski (1983) provided a systematic analysis of research on vocabulary instruction and comprehension. She analyzed eight studies "that tested the premise that improving vocabulary would beneficially affect reading comprehension" (pp. 257–258). All studies demonstrated growth in word knowledge, but only four revealed a positive impact on comprehension. Mezynski noted that there were "methodological problems" and interpretation difficulties in that some studies were significantly underwritten in the methods sections and there was considerable variation across studies in the number of words taught, instructional procedures employed, and assessment tasks. In spite of these limitations, Mezynski identified three factors that were linked to enhanced comprehension: more practice of target words, breadth in instructional techniques, and encouragement of active processing.

Second, Graves (1986) identified 14 vocabulary intervention studies, 8 of which indicated some positive effect of vocabulary instruction on comprehension. Like Mezynski (1983), Graves noted limitations in methodology or detail in reports, leaving him to conclude that only the three studies by Beck, McKeown, and colleagues (Beck, Perfetti, & McKeown, 1982; McKeown, Beck, Omanson, & Perfetti, 1983; McKeown, Beck, Omanson, & Pople, 1985) provided "convincing evidence that teaching vocabulary can increase comprehension of texts containing the words taught" (p. 61). From his analysis of these studies, Graves concluded that, in order for vocabulary instruction to affect comprehension, it needs to be multifaceted, of extended duration, require active processing, include multiple encounters with words, involve semantic associations among words, and promote automaticity in lexical access.

Third, Stahl and Fairbanks (1986) conducted a meta-analysis of 52 studies that explored the effects of vocabulary instruction on learning word meanings and reading comprehension. Results revealed a mean effect size of .97 for studies in which comprehension was assessed using passages that included words that were taught directly to the students. The effect size was more modest (.30) for studies whose assessments (typically standardized tests) did not include words that were taught. Stahl and Fairbanks concluded that three factors were most strongly linked to comprehension: "The most effective vocabulary teaching methods included both definitional and contextual information in the programs, involved the students in deeper processing, and gave the students more than one or two exposures to the to-be-learned words" (p. 72).

Illustrative studies It is a trio of studies by Beck, McKeown, and colleagues that are considered to be the seminal research demonstrating how vocabulary instruction in specific words can affect reading comprehension. In the first study (Beck et al., 1982), 27 fourth-grade students were taught the meanings of 108 low-frequency words presented in categories (e.g., the *moods* category included nine words such as *jovial*, *glum*, *placid*, *indignant*). Lessons spanned 5 months in weekly cycles totaling about 2.5 hours; each cycle focused on the 8–10 words within one category. The five lessons for each weekly cycle had students delve increasingly deeply into semantic associations by way of definitional and associational tasks. Games and an out-of-school “Word Wizard” activity were also aspects of the instruction. Students were exposed to 61 words 10–18 times across the lessons (i.e., words with *some* exposures), and students were exposed to the remaining 43 words between 24 and 40 times (i.e., words with *many* exposures). Students were pre- and posttested only on a comparable set of 43 words (i.e., *none* words).

Students receiving the vocabulary instruction outperformed matched-paired students who received conventional language arts instruction only. This was true for a test of word definitions and a test for speed of lexical access (a reaction time measure). Results for a comprehension test that involved the prompted recall of narratives including a high proportion of target words (1 out of every 11) were somewhat equivocal. There was a slight advantage for a *many*-word story when compared to a *none*-word story, but there were no discernable effects for a *some*-word story. Beck et al. concluded that the instructional program was effective in teaching specific words (experimentals, on average, learned 85 new words) and that intensive vocabulary instruction held promise in enhancing students’ comprehension of stories containing words so taught.

To explore vocabulary instruction and reading comprehension further, Beck, McKeown, and colleagues conducted a modified replication of their study (McKeown et al., 1983), again with fourth graders and using the same vocabulary and instructional program. The modifications involved revising the narrative comprehension measure such that the *many*, *some*, and *none* stories were more comparable in plot structure and overall readability. In addition, the comprehension assessment was changed from a prompted recall to a free recall task. The researchers also added a second comprehension measure consisting of a multiple-choice test for each of the three passages.

Results for the two vocabulary measures—the word definition and speed-of-lexical-access tests—replicated results from the first study: children in the experimental group outperformed control-group children on both measures for the *many* and *some* words. Results for the revised and new comprehension measures revealed that experimental-group children had greater recall and answered more comprehension questions correctly than students in the control group for both the *some* and *many* words.

In a third study with fourth graders, McKeown et al. (1985) sought to tease out how type of instruction and frequency of word encounters affected vocabulary learning and comprehension. Students received one of three treatments: *Traditional Instruction*, which primarily was teaching definitions; *Rich Instruction*, which was the kind of instruction employed in the previous two studies, but without the out-of-classroom component; or *Extended Rich Instruction*, instruction like the preceding but with the out-of-school component. Students were provided either 4 or 12 encounters with instructed words.

Results revealed that all three treatments exceeded a control group on a test of definitional knowledge, and 12 encounters resulted in better performance than 4 encounters on several vocabulary measures. However, special circumstances were required to enhance comprehension of texts containing taught words. Specifically, only *Rich Instruction* or *Extended Rich Instruction* in the high-encounter condition enhanced comprehension of texts containing taught words. In other words, definitional-only (*Tra-*

ditional) instruction, even at only the 4-encounter level, is sufficient for producing a basic level of understanding of new vocabulary. In order to enhance comprehension, however, a much more elaborate form of instruction that included many encounters with target vocabulary was needed.

As significant and influential as this research program was, several questions about it were posed. For example, Stahl, Burdge, Machuga, and Stecyk (1992) conducted a study that suggested that it was not necessary for words to be grouped in semantic clusters for effective vocabulary instruction. The RAND Reading Study Group (Snow, 2002) noted that the Beck and McKeown studies “used rather artificial texts heavily loaded with unfamiliar words” [that had been taught explicitly] and that “little, if any, research addresses the question of which conditions—the types of texts, words, readers, and outcomes—can actually improve comprehension” (p. 36). There also is little evidence (or exploration for that matter) as to whether the ambitious kind of instruction like that employed in the Beck and McKeown program (Beck et al., 2002) enhances students’ general text comprehension, that is, on texts for which there was no instruction in specific embedded words.

In summary, the work of Beck, McKeown, and colleagues and other researchers supports the necessity of several key instructional conditions to be present if teaching word meanings is to promote comprehension. Stahl and Fairbanks (1986) documented three essential conditions through their meta-analysis: (a) provide both definitional and contextual information; (b) promote the deep processing of words and meanings; and (c) give learners multiple encounters with to-be-learned words. Several additional studies (e.g., Curtis & Longo, 2001; Medo & Ryder, 1993) support the efficacy of elaborate, deep, and multiple-exposure vocabulary instruction to promote reading comprehension. As Beck and McKeown (2007a) noted, “word learning does not occur easily” (p. 264), nor, I would argue, does enhancing comprehension of texts that contain instructed words.

Teaching word-learning strategies

Graves’s (2006) third component of a comprehensive vocabulary program involves teaching students strategies for analyzing morphemic, or word-structure, clues (root words, prefixes, suffixes, Latin/Greek roots) and context clues as ways to enhance their ability derive or infer the meanings of unfamiliar words. Nagy and Anderson (1984) provided a rationale for teaching word-learning strategies, noting that “for every word known by a child who is able to apply morphology and context, an additional one to three words should be understandable” (p. 304).

Instruction in morphological analysis Anglin’s (1993) research documented that children grow significantly across Grades 1 to 5 in “morphological problem solving,” or their ability to employ “tacit or explicit knowledge of the rules of morphological word formation” to derive word meanings (pp. 151–152). There is also evidence that instruction in morphemic elements and morphological analysis enhances this development and is particularly appropriate for students in the upper elementary grades and beyond (Nagy, Diakidoy, & Anderson, 1993; White, Power, & White, 1989).

Early research on teaching morphology (e.g., Hanson, 1966; Otterman, 1955; Thompson, 1958) was often methodologically limited and inconclusive (Baumann, Bradley, Edwards, Font, & Hruby, 2000). Subsequent research, however, demonstrated that instructional programs were effective in promoting students’ knowledge of affixes and word roots and their ability to use that knowledge to infer the meanings of morphologically related novel words (e.g., Graves & Hammond, 1980; White, Sowell, & Yanagihara, 1989; Wysocki & Jenkins, 1987).

For example, in the Graves and Hammond (1980) study, seventh graders in an intervention group not only learned the meanings of prefixes but also outperformed controls in using that knowledge to determine the meanings of difficult transfer words that contained the prefixes they were taught. I could find only two morphemic analysis instructional studies that included a comprehension dependent measure (Hanson, 1966; Otterman, 1955), but neither study demonstrated transfer of word-learning instruction to a generalized measure of reading comprehension.

Instruction in contextual analysis Instruction in contextual analysis is not nearly as effective as direct instruction for acquiring the meaning of a *specific* word (Baumann et al., 2003; Sternberg, 1987), but there is considerable evidence that teaching students to develop their ability to use context clues holds promise for enhancing students' ability to acquire *many* word meanings through independent reading. The impact of such instruction on reading comprehension, however, remains somewhat obscure.

Early studies on context-clue instruction were inconclusive (cf., Askov & Kamm, 1976; Hafner, 1965), but later studies demonstrated that instruction in the identification and use of context clues promoted independent word learning to some degree. For example, Sternberg and colleagues (Sternberg & Powell, 1983; Sternberg, Powell, & Kaye, 1983) provided a theoretical perspective on contextual analysis and a set of context-clue types for instruction, which they then tested in two instructional studies with high school students and adults (see Sternberg, 1987, for brief descriptions of these studies). Results provided modest support for the efficacy of teaching specific context clue types to promote the ability to infer word meanings through context.

Other studies demonstrated that generalized instruction in context clues (e.g., Jenkins, Matlock, & Slocum, 1989) or instruction in specific context-clue types (e.g., Buikema & Graves, 1993; Carnine, Kame'enui, & Coyle, 1984; Patberg, Graves, & Stibbe, 1984) enhanced upper elementary and middle school students' ability to infer the meanings of novel, difficult words that were provided in reasonably rich contexts.

Goerss, Beck, and McKeown (1999) looked descriptively at the impact of a modeling and guided practice procedure for developing contextual analysis abilities of five fifth- and sixth-grade struggling readers. In a one-on-one setting, one of the investigators employed a five-component, interactive procedure to guide students through the use of context clues to infer word meanings. Goerss et al. reported that all participants improved on a word-meaning acquisition test (McKeown, 1985) following the intervention.

A meta-analysis by Fukkink and de Glopper (1998) of 21 intervention studies revealed a moderate effect size (mean $d = 0.43$) for teaching students to use context clues. After reviewing many of the same studies, however, Kuhn and Stahl (1998) cautioned that the effects might have been due at least as much to *practice* in contextual analysis as to explicit *instruction* in how to look for and apply context clues.

In summary, the research on teaching contextual analysis suggests that such efforts are worthwhile. However, like the research on morphemic analysis, the studies reviewed thus far provide little insight about the potential impact of contextual analysis instruction on text comprehension.

Multi-strategy instruction Several studies that explored the combination of teaching morphemic and contextual analysis provided some insight into the effects of such training on reading comprehension. Tomesen and Aarnoutse (1998) explored the impact of an intervention program in morphemic and contextual analysis on Grade 4 children in the Netherlands. Employing a direct instruction and reciprocal teaching model, children were provided twelve 45-minute, small-group lessons on morphemic and contextual analysis. Results indicated that experimental-group children outperformed

uninstructed controls on two measures that evaluated students' ability to derive the meanings of unfamiliar words. Groups did not differ, however, on a general measure of reading comprehension: "A transfer effect to more general reading comprehension measures was not found to occur" (p. 123). Tomesen and Aarnoutse speculated that the intervention program was "probably too limited in length and breadth to produce a transfer effect on reading comprehension" (p. 124).

Colleagues and I also explored the effects of combined morphemic and contextual analysis instruction on word learning and the possible transfer of such instruction to reading comprehension in two intervention studies with fifth graders. We hypothesized that the instrumentalist hypothesis—word knowledge directly enables reading comprehension—might be extended such that enhancing morphemic and contextual analysis ability would lead to greater vocabulary knowledge which, in turn, would then lead to greater reading comprehension (see a later discussion of Nagy, Berninger, and Abbott's, 2006, study of morphological contributions to literacy abilities).

In the first study (Baumann, Edwards, Font, Tereshinski, Kame'enui, & Olejnik, 2002), we provided students twelve 50-minute explicit instruction lessons on morphemic and contextual analysis. Results revealed that intervention students' performance exceeded that of instructed controls on immediate posttests in ability to (a) derive the meanings of novel words that contained the morphological elements we taught, and (b) infer the meanings of novel words presented in rich contexts. We found no persistence in these effects on delayed posttests. Most relevant to this discussion, however, we found that experimentals did *not* outperform controls on questions about passages that included morphemically and contextually decipherable words. In other words, students' successful acquisition of word-learning strategies did not appear to enhance their text comprehension.

One of our explanations for the lack of a comprehension effect was the same as that of Tomesen and Aarnoutse (1998): We surmised that the intervention was too short in duration. We also considered measurement as a possible error source (limitations of a true/false comprehension question format we used). Of course, a plausible explanation was that our findings simply refuted the extended instrumentalist hypothesis: "Instruction in the generalizable linguistic cues from morphemic elements and context has insufficient transfer power alone to influence reading comprehension" (Baumann et al., 2002, p. 169).

Our second study (Baumann, Edwards, Boland, Olejnik, & Kame'enui, 2003) was more extensive and possessed enhanced external validity. We included more participants (157 students from 8 classrooms), classroom teachers provided the instruction, the study was longer in duration (33 lessons across 2 months), and morphemic and contextual analysis lessons were embedded in content lessons for a unit on the U.S. Civil War taught from the adopted social studies textbook. Our comparison group received the same content instruction but, rather than instruction word-learning strategies, students were provided explicit instruction in key vocabulary (Beck, McKeown, & Omanson, 1987) taken from the daily social studies lessons.

Results of this second study were similar to the first. There was a strong effect for morphemic analysis instruction. There were somewhat equivocal findings, however, for a measure sensitive to contextual analysis, with experimentals outperforming comparison group students on a delayed posttest but not on an immediate posttest. And, as in the first study, there were no group differences on a comprehension test, which was constructed from a slightly adapted social studies textbook excerpt the students had not read previously.

Given the lack of a comprehension effect in both of our studies—reinforced by the findings of Tomesen and Aarnoutse (1998) and several earlier studies (Hanson, 1966; Otterman, 1955) that included comprehension measures—one must conclude that there

currently is no empirical evidence for enhanced reading comprehension as a function of word-learning strategy instruction. Perhaps it was simply naïve to expect an effect given the multiple factors that affect reading comprehension (Snow, 2002), as well as the relatively short duration of our intervention, which W. E. Nagy pointed out (personal communication, December 7, 2001), did not include other comprehension-enhancing factors such as wide reading.

In summary, there is evidence that word-learning strategy instruction—especially instruction in morphemic analysis—is a viable component of a broadly based vocabulary program. There exists no evidence as of yet, however, that word-learning strategy competence directly enhances text comprehension.

Fostering word consciousness

Graves (2006) defined *word consciousness* as “an awareness of and interest in words and their meanings” (p. 7). Nagy (2005) elaborated, stating that word consciousness includes “various aspects of words—their meanings, their histories, relationships with other words, word parts, and most importantly, the way writers use words effectively to communicate” (p. 30). Thus, word consciousness involves both a cognitive dimension (e.g., awareness of word choice; understanding that words have recurring common Latin and Greek roots) and an affective one (e.g., interest in word play; appreciation of figurative language) (Anderson & Nagy, 1992).

Word consciousness is often listed as a separate component of a vocabulary program, as is the case in this research review. However, most vocabulary researchers and theorists acknowledge that word consciousness ought to be integrated across all vocabulary teaching and learning processes. For instance, Graves and Watts-Taffe (2002) viewed word consciousness as “crucial to learners’ success in expanding the breadth and depth of their word knowledge over the course of their lifetimes” (p. 145), and Stahl and Nagy (2006) argued that “word consciousness should permeate the vocabulary program” (p. 53).

Word consciousness is often placed within the domain of *metalinguistic awareness*, or “the ability to reflect on and manipulate structural features of language” (Nagy & Scott, 2000, p. 274). Metalinguistic awareness is usually thought of in terms of phonological or phonemic awareness (Adams, 1990), but it also applies to vocabulary in the form of (a) *syntactic awareness*: the ability to reflect on how word order affects meaning; (b) *metasemantic awareness*: the understating that words vary in meaning, as in polysemy (multiple meaning words), denotative/connotative meanings of words, and literal/figurative senses of words; and (c) *morphological awareness*: the realization that words may be made up of meaningful constituent parts (for elaboration on the various types of metalinguistic awareness, see Nagy & Scott, 2000; Nagy, 2007; Scott & Nagy, 2004).

The latter component—morphological awareness—has garnered particular attention with respect to its role and function in vocabulary learning (Carlisle, 2003, 2007; Nagy, 2007). For instance, Nagy et al. (2006) demonstrated through structural equation modeling that for students in Grades 4 to 8 morphological awareness contributed significantly to both students’ (a) reading comprehension as mediated by their vocabulary knowledge (i.e., morphological awareness contributes to vocabulary knowledge, which then contributes to reading comprehension), and (b) reading comprehension directly (i.e., morphological awareness has a unique, independent relationship to reading comprehension). Nagy (2005) accounted for this complex relationship between meta-knowledge, vocabulary, and reading comprehension in his reciprocal model of vocabulary and reading comprehension, noting that “vocabulary contributes both directly and indirectly to reading comprehension” (p. 36).

There is no shortage of pedagogical advice for addressing word consciousness (e.g., Blachowicz & Fisher, 2004; Graves & Watts-Taffe, 2002; Scott & Nagy, 2004), but there is little indication that such practices are incorporated into day-to-day vocabulary instruction. Scott, Jamieson-Noel, and Asselin (2003) observed 23 upper-elementary teachers in Canada for over 300 hours and found that about half the instructional time was related to literacy. However, the time spent on vocabulary in either language arts or content subjects constituted only 6% of the total instructional time, and “most [vocabulary] instruction involved mentioning and assigning rather than teaching” (p. 269). Scott et al. also noted that there was a general absence of depth of vocabulary instruction and a “lack of instruction devoted to ... metalinguistic awareness” (p. 283).

Empirical evidence on the impact of instructional attention to word consciousness is scant. Lubliner and Smetana (2005) explored the effects of a 12-week-long, multifaceted, metacognitive vocabulary program for fifth graders in low-performing Title I schools. Their program was designed “to help children monitor comprehension of words and internalize and implement word-learning strategies to increase comprehension of natural texts” (p. 166)—select aspects of metalinguistic awareness.

The classroom teachers modeled, coached, and provided guided practice in a series of vocabulary strategies that involved self-regulation, clarifying, and self-monitoring. The vocabulary strategies were integrated into social studies lessons based on the adopted social studies textbook. Results revealed that students in the intervention demonstrated significant pretest-to-posttest gains on measures of metacognitive skill, reading vocabulary, and reading comprehension. When comparing the intervention students to fifth-grade students in an above-average-performing school who did not receive the vocabulary intervention, Lubliner and Smetana (2005) reported that the “gap” between the two groups diminished, with “large, significant differences before the intervention [favoring students in the comparison school] and small, nonsignificant differences following the intervention” (p. 163).

Colleagues and I (Baumann, Ware, & Edwards, 2007) conducted a year-long formative experiment (Reinking & Bradley, 2008) in a fifth-grade classroom. We used Graves’s (2006) four-part structure—which, of course, included word consciousness—to provide pedagogical attention to vocabulary within reading, language arts, and social studies classes. Students demonstrated growth on several cognitive measures of vocabulary knowledge. There also was evidence through analysis of students’ dialogue and writing, parent questionnaires, and student surveys that students (a) grew in appreciation of words and their nuanced meanings; (b) recognized authors’ and speakers’ deliberate use of words to convey specific meanings; (c) acquired an interest in word and language play; and (d) developed diction such that they were conscious of how word choice affected their oral and written expressions.

In conclusion, there is a theoretical base and correlational evidence for a relationship between word consciousness and reading vocabulary and comprehension. There also is preliminary evidence that programs focusing on one or more dimensions of word consciousness may enhance students’ vocabulary learning and appreciation as well as their comprehension.

CONCLUSION

Summary

It was the purpose of this chapter to explore the nexus of meaning between vocabulary and comprehension. The relationship between word knowledge and text understanding has been demonstrated empirically in many ways and along multiple dimensions both historically and contemporarily. Theorists have attempted to explain this relationship

by proposing various positions or hypotheses, six of which were articulated in this chapter. Research on pedagogical attention to vocabulary was then examined in relation to Graves's (2006) four-component framework for comprehensive vocabulary instruction. Following is a summary of those findings.

Providing rich and varied language experiences

- Reading aloud and independent reading are associated with vocabulary growth.
- Word repetition, multiple readings, reader-listener interactions, and attention to specific words enhance vocabulary development during read-alouds.
- There is some evidence that reading aloud and independent reading are associated with later reading achievement and comprehension, perhaps mediated by vocabulary growth.

Teaching individual words

- There is considerable evidence that specific words can be taught directly.
- There is some evidence that elaborate, rich instruction in specific words enhances reading comprehension.
- Basic, brief vocabulary instruction provides entry-level word knowledge, but it takes intensive vocabulary instruction to affect comprehension.
- To enhance comprehension, vocabulary instruction should provide definitional and contextual information, multiple exposures to words, and deep processing of words.

Teaching word-learning strategies

- There is strong evidence that instruction in morphemic analysis enhances students' ability to derive novel morphologically decipherable words.
- There is evidence that instruction in contextual analysis promotes students' ability to infer the meanings of novel words in text.
- There is no evidence that word-learning strategy instruction has a direct impact on reading comprehension.

Fostering word consciousness

- There is a relationship between various word consciousness, or metalinguistic, abilities and vocabulary knowledge.
- Morphological awareness, mediated by vocabulary knowledge, predicts reading comprehension.
- There is limited evidence that instructional attention to word consciousness promotes students' vocabulary and comprehension.

The six hypotheses

What do these findings suggest about the validity of the six hypotheses for vocabulary-comprehension associations? Which of them have explanatory power and under what circumstances? Nagy (2005) posited that "these hypotheses are all at least partly true" (p. 33), and Stahl (1991) noted that "the 'truth' captured by each of these hypotheses depends on the particular contexts in which a word is found, the way the task of comprehension is defined, and the amount and types of knowledge a person has about a word" (p. 183).

This review supports Stahl's (1991) relational view of vocabulary-comprehension associations. For instance, the enhanced comprehension of a text read aloud or read independently by a learner appears to be mediated by vocabulary knowledge and growth. Therefore, the input hypothesis (considerable exposure to decontextualized language) and the access hypothesis (fluency by the person reading aloud or the learner who is reading independently) are potential explanations for a vocabulary-comprehension relationship for Graves's component 1, rich and varied language experiences.

In contrast, the instrumentalist hypothesis (word knowledge enables comprehension) and the knowledge hypothesis (a learner's schema related to new words and textual material) would seem to support enhanced comprehension through the ambitious teaching of individual words, Graves's component 2. And there is support for the metalinguistic hypothesis (manipulating and reflecting on words and language) when it comes to word consciousness as a factor that enhances reading comprehension, component 4. As Nagy (2005) stated regarding the various hypotheses, "together they form a somewhat complex picture of the causal relationship between vocabulary knowledge and reading comprehension" (pp. 33–34).

Implications

For practice A critical instructional consideration is aligning one's vocabulary instructional goals with appropriate pedagogy (Beck & McKeown, 2007b). Graves and Pinn (1986, pp. 596–597) articulated this cogently: "Different methods of teaching words are appropriate in different circumstances.... there is no one best method of teaching words." Instead, they argued, that "various methods have both their costs and benefits and will be very appropriate and effective in some circumstances and less appropriate and effective in others."

This review reinforces a costs-and-benefit perspective. For instance, if one hopes to acquaint students with a general familiarity or a foot-in-the-door level of knowledge of many words, a teacher could either (a) expose students to many words through reading aloud or independent reading via Graves's "rich and varied language experiences" component, or (b) teach the basic meanings of a large set of words through brief instructional encounters as per Graves's "teaching individual words" component. These instructional actions would result in broad benefits at a relatively low cost.

We know, however, that exposure alone or brief instructions are not likely to result in improved text comprehension. For that to occur, vocabulary instruction must be of a more ambitious nature and involve elaborated instruction in passage-critical words as per Graves's "teaching individual words" component. This kind of instruction would result in a more specific benefit but at a relatively high cost. It is not as though one goal is more important than the other, but it is critical for educators to be aware of pedagogical costs and benefits when determining how to allocate precious time for vocabulary instruction.

A vocabulary program that enhances comprehension also must be multifaceted (Kamil & Hiebert, 2005; Nagy, 2005) and span an extended period of time. "Effective vocabulary instruction is a long-term proposition. Attention to vocabulary growth has to start early, in preschool, and continue throughout the school years" (Nagy, 2005, p. 28). Although the specific type of vocabulary instruction provided depends on the instructional goal and age of the student, there must be a persistent "focus on and commitment to vocabulary instruction" (Nagy, 2005, p. 28) throughout students' academic careers.

Thus, the admonition for teachers in preschool to postsecondary classrooms is to teach vocabulary often, well, and in appropriate curricular contexts. Practitioners also should realize that not all vocabulary instructional efforts will—or, for that matter,

should—result in enhanced reading comprehension. Thoughtful cost/benefit awareness planning will inform the selection of specific vocabulary instructional approaches that align with particular instructional goals. Fortunately, there is a plethora of empirically grounded vocabulary instructional procedures and suggestions available in the applied literature from which teachers can draw (e.g., Baumann & Kame'enui, 2004; Beck et al., 2002; Blachowicz & Fisher, 2006; Block & Mangieri, 2006; Graves, 2006; Hiebert & Kamil, 2005; Johnson, 2001; Stahl & Nagy, 2006; Wagner et al., 2007).

For research One theme of future research should be to explain further the intricacies of vocabulary-comprehension associations. The RAND Reading Study Group's (Snow, 2002) recommendations in this area are still germane today: "Research is called for that examines how the relationship between vocabulary knowledge and reading comprehension depends on specific conditions, including the type of reader, type of text, proportion of unfamiliar words, their role in the text, and the purpose for reading or the outcome being considered" (p. 88). In other words, descriptive and correlational studies are needed to examine the conflux of reader, text, task, and context factors related to if, how, and when word knowledge induces reading comprehension.

A second theme of future research should explore vocabulary interventions with the potential to enhance reading comprehension. Specifically, I see the need for (a) replication research and (b) extended, complex intervention studies.

Replication research is relatively infrequent in literacy education, perhaps because researchers consider it unnecessary, expensive in time or money, or unrewarded; or because journal editors may not view replication as worthy of journal space. The failure to conduct and report replication research promotes reliance one-shot vocabulary studies which, even if well conducted, are just that—unique investigations bound by the particular research sample, time, method, and context. Robinson and Levin (1997) argue that replication studies "provide *generalizability* encouragement by demonstrating the initial findings are not limited to the unique participant characteristics of a single sample" (p. 25).

It would behoove literacy researchers, funding agencies, journal editorial boards, and professional organizations, therefore, to value and encourage replications, as is typically the case in the physical, biological, and medical sciences. Robinson and Levin (1997) promote the conduct and publication of "multiple-experiment replication-and-extension studies" (p. 25). Unfortunately, this is uncommon in vocabulary instruction research, save for the triad of studies by Beck and colleagues (Beck et al., 1982; McKown et al., 1983, 1985).

There is an important caveat to acknowledge here, however. *Replication* should not be construed as the conduct of multiple quantitative or experimental studies *only*. Berliner (2002) argued that the powerful context effects in education research ought to be embraced and explored by "replications" (my usage here) within and across other methodological frameworks that examine specific context effects, or "local knowledge." Berliner argued: "Therefore, ethnographic research is crucial, as are case studies, survey research, time series, design experiments, action research, and other means to collect reliable evidence" (p. 20). This is sage advice given the pressures to conduct and trust only "scientifically based research" as described by the No Child Left Behind Act of 2001.

By "extended, complex vocabulary intervention studies," I refer to Pressley, Disney, and Anderson's (2007) call for research that addresses "the big hypothesis" (p. 222). Pressley et al. argue that it is time to take what is known about quality classroom reading instruction (Gambrell, Morrow, & Pressley, 2007) and effective vocabulary instruction (Graves, 2006; Stahl & Nagy, 2006) and "move beyond the individual mechanisms of vocabulary teaching and learning" (p. 225). They propose instead exploring, the big

hypothesis, or "the vocabulary instructional flooding hypothesis" (p. 225). Such studies would "flood" classrooms with research-based general pedagogy and specific vocabulary instructional practices so that researchers could explore complex, multifaceted, and long-term (at least an academic year) vocabulary interventions.

These kinds of studies would be particularly relevant to the issue of researching vocabulary-comprehension connections, for Pressley et al. (2007) argue that a "massive intervention over a long term has a better chance of producing discernable, more general effects [i.e., on reading comprehension] than the shorter term studies of the past" (p. 225). This type of messy research is needed in order to explore the complex contexts and interactions (Berliner, 2002) inherent in vocabulary instructional programs and to examine both commonalities and variation between and within them.

Finally, additional research is needed in two areas not addressed directly in this review: vocabulary assessment and vocabulary instruction for English learners. With regard to assessment, Pearson, Hiebert, and Kamil (2007) argued that vocabulary assessment is "grossly undernourished" (p. 282). Given the inadequacy of current assessment tools, Pearson et al. call for vocabulary assessment research so that the field might "develop and validate measures that will serve us in our quest to improve both vocabulary research and, ultimately, vocabulary instruction" (p. 283).

With regard to research on vocabulary learning and teaching for English learners, there has been some attention to this topic from the perspective of applied linguistics (e.g., Nation, 2001; Schmitt & McCarthy, 1997) and more recently from literacy educators (e.g., Bravo, Hiebert, & Pearson, 2007; Graves & Fitzgerald, 2006; Snow & Kim, 2007). However, the gaps in our knowledge are many (Blachowicz & Fisher, 2000) and there is urgency in exploring vocabulary instruction for English learners given the changing linguistic demographic in schools.

In conclusion, as Davis (1944) noted over 60 years ago, it is clear that word knowledge and reading comprehension are inextricably linked. Understanding in what ways they are linked and the nature of associational and causal links between the two, however, has been and remains a psycholinguistic-educational challenge. The RAND Reading Study Group (Snow, 2002) noted succinctly and understatedly that "the role of vocabulary instruction in enhancing comprehension is complex" (p. 35). I hope that this review has shed some light on this complexity and may guide researchers as they continue to unravel the enigmatic nexus of meaning between reading vocabulary and comprehension.

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